REMARKS

In the Office Action, the Examiner provisionally rejected claims 1-9 under 35 U.S.C. §101 as claiming the same invention as that of claims 1-9 of co-pending Application 09/792,485. The Examiner also rejected claims 1-9 under 35 U.S.C. §103(a) as being unpatentable over United States Patent 6,006,127 issued to Van Der Brug, et al. ("Van Der Brug") in view of United States Patent 5,299,288 issued to Glassman, et al. ("Glassman") and United States Patent 6,064,904 issued to Yanof, et al. ("Yanof").

In this Amendment, Applicant has canceled claims 1-9. Applicant has added new claims 10-21. Accordingly, claims 10-21 will be pending after entry of this Amendment.

I. Rejection of Claims 1-9 under § 101

In the Office Action, the Examiner provisionally rejected claims 1-9 under 35 U.S.C. §101 as claiming the same invention as that of claims 1-9 of co-pending Application 09/792,485. Applicant notes that Application 09/792,485 is abandoned. Therefore, the claims in Application 09/792,485 will not be patented. Furthermore, the Examiner's provisional rejection is moot in view of the fact that claims 1-9 in the present application have been canceled.

II. Notice of Related U.S. Patent Application

Applicant draws the Examiner's attention to pending U.S. Patent Application 09/793,828, which is related to the present application. A copy of a current Office Action in the U.S. Patent Application 09/793,828 is attached for the Examiner's review.

III. New Claims 10-13

In this Amendment, Applicant has added claims 10-13. Applicant respectfully submits that claims 10-13 are fully supported by the specification. *See Figure 5 of the application.* Claims

11-13 are dependent on independent claim 10. Claim 10 recites a method for maintaining a trajectory of a first tracked instrument toward a target site in a human patient, as the first tracked instrument is moved in space toward the target in the patient. The method uses a second image capture instrument to construct an image of the target site that is defined by reference to an image-coordinate system. The method correlates the image coordinate system with an instrument coordinate system to place the target-site coordinate in the instrument coordinate system. The method determines whether the target site has moved off the first tracked instrument's trajectory towards the target site. After determining that the target site has moved off the first tracked instrument's trajectory towards the target site, the method computes a correction to the orientation of the first tracked instrument to re-orient the first tracked instrument towards the target site. The method uses the computed correction to correct the orientation of the first tracked instrument to maintain the first tracked instrument's defined trajectory towards the target site even as the first tracked instrument is moved in space.

Applicant respectfully submits that the combination of Van Der Brug, Glassman and Yanof does not disclose, teach, or even suggest such a method. Van Der Brug describes an image assisted surgery system that shows to a user, a position of a surgical instrument in an operating area in the body of a patient during a surgical operation. Van Der Brug's system uses a camera unit and two image sensors to measure the position of a set of IREDs, which are attached to the surgical instrument. Van Der Brug's system does not determines whether the target site has moved off the first tracked instrument's trajectory towards the target site.

Glassman describes an image directed robotic system for precise robotic surgery. Glassman's system includes a camera unit and sensors for tracking a set of LEDs that are

attached to the end of a robotic arm that holds a surgical instrument. Glassman's system is used to remove tissue in a patient's body. The process of removing the tissue is automated by Glassman computer system. This automated process prevents the surgical instrument from going outside a pre-determined operating area during the removing of the tissue. Glassman's system requires the patient's body to be locked on a firm base. *See Glassman, column 9, lines 27-29.* Thus, Glassman's system does not provide a mechanism that determines whether the target site has moved off the first tracked instrument's trajectory towards the target site.

Yanof describes a CT scanner with a virtual needle display for planning image guided interventional procedures. Yanof's scanner describes a system that allows a user to move a needle using a mechanical arm, while simultaneously viewing the needle from multiple angles. Yanof's scanner does not describe a system that allows the surgical instrument to be adjusted when the patient's body moves. Yanof's system describes a surgical instrument that is moved when the couch on which the patient lies is moved. *See Yanof, column 6, lines 5-9.* Thus, Yanof's system moves the mechanical arm in response to a movement in the couch and not a change in the target site.

In contrast, claim 10 recites a method that (1) uses a second image capture instrument to construct an image of the target site that is defined by reference to an image-coordinate system; (2) correlates the image coordinate system with an instrument coordinate system to place the target-site coordinate in the instrument coordinate system; (3) computes a correction to the orientation of the first tracked instrument to re-orient the first tracked instrument towards the target site, when it determines that the target site has moved off the trajectory towards the target site; and (4) uses the computed correction to correct the orientation of the first tracked instrument

to maintain the first tracked instrument's defined trajectory towards the target site even as the first tracked instrument is moved in space.

Accordingly, Applicant respectfully submits that the combination of Van Der Brug, Glassman and Yanof does not render claim 10 unpatentable. As claims 11-13 are dependent directly on claim 10, Applicant respectfully submits that claims 11-13 are patentable over the combination of Van Der Brug, Glassman and Yanof for at least the reasons that were discussed above for claim 10.

IV. New Claims 14-17

In this Amendment, Applicant has added claims 14-17. Applicant respectfully submits that claims 14-17 are fully supported by the specification. *See Figure 5 of the application.* Claims 15-17 are dependent on independent claim 14. Claim 14 recites a processor-readable medium comprising a program of instructions for execution by a processor. The processor performs a method of maintaining a trajectory of a first tracked instrument toward a target site in a human patient, as the first tracked instrument is moved in space. The program of instructions includes instructions for using a second image capture instrument to construct an image of the target site that is defined by reference to an image-coordinate system. The program of instructions includes instructions for correlating the image coordinate system with an instrument coordinate system-to place the target-site coordinate in the instrument coordinate system. The program of instructions includes instructions for determining whether the target site has moved off the first tracked instrument's trajectory towards the target site. The program of instructions includes instructions for computing a correction to the orientation of the first tracked instrument to re-orient the first tracked instrument towards the target site, after determining that the target site has moved off the

first tracked instrument's trajectory towards the target site. The program of instructions includes instructions for using the computed correction to correct the orientation of the first tracked instrument to maintain the first tracked instrument's defined trajectory towards the target site even as the first tracked instrument is moved in space.

Applicant respectfully submits that the combination of Van Der Brug, Glassman and Yanof does not disclose, teach, or even suggest such a method. Van Der Brug describes an image assisted surgery system that shows to a user, a position of a surgical instrument in an operating area in the body of a patient during a surgical operation. Van Der Brug's system uses a camera unit and two image sensors to measure the position of a set of IREDs, which are attached to the surgical instrument. Van Der Brug's system does not determines whether the target site has moved off the first tracked instrument's trajectory towards the target site.

Glassman describes an image directed robotic system for precise robotic surgery. Glassman's system includes a camera unit and sensors for tracking a set of LEDs that are attached to the end of a robotic arm that holds a surgical instrument. Glassman's system is used to remove tissue in a patient's body. The process of removing the tissue is automated by Glassman computer system. This automated process prevents the surgical instrument from going outside a pre-determined operating area during the removing of the tissue. Glassman's system requires the patient's body to be locked on a firm base. *See Glassman, column 9, lines 27-29.* Thus, Glassman's system does not provide a mechanism that determines whether the target site has moved off the first tracked instrument's trajectory towards the target site.

Yanof describes a CT scanner with a virtual needle display for planning image guided interventional procedures. Yanof's scanner describes a system that allows a user to move a

needle using a mechanical arm, while simultaneously viewing the needle from multiple angles. Yanof's scanner does not describe a system that allows the surgical instrument to be adjusted when the patient's body moves. Yanof's system describes a surgical instrument that is moved when the couch on which the patient lies is moved. *See Yanof, column 6, lines 5-9.* Thus, Yanof's system moves the mechanical arm in response to a movement in the couch and not a change in the target site.

In contrast, claim 14 recites a processor readable medium comprising instructions for (1) using a second image capture instrument to construct an image of the target site that is defined by reference to an image-coordinate system; (2) correlating the image coordinate system with an instrument coordinate system to place the target-site coordinate in the instrument coordinate system; (3) computing a correction to the orientation of the first tracked instrument to re-orient the first tracked instrument towards the target site, when it determines that the target site has moved off the trajectory towards the target site; and (4) using the computed correction to correct the orientation of the first tracked instrument to maintain the first tracked instrument's defined trajectory towards the target site even as the first tracked instrument is moved in space.

Accordingly, Applicant respectfully submits that the combination of Van Der Brug, Glassman and Yanof does not render claim 14 unpatentable. As claims 15-17 are dependent directly on claim 14, Applicant respectfully submits that claims 15-17 are patentable over the combination of Van Der Brug, Glassman and Yanof for at least the reasons that were discussed above for claim 14.

V. New Claims 18-21

In this Amendment, Applicant has added claims 18-21. Applicant respectfully submits that claims 18-21 are fully supported by the specification. *See Figure 5 of the application.* Claims 19-21 are dependent on independent claim 18. Claim 18 recites a device for maintaining a trajectory between a tip of a first tracked instrument and a target site in a patient's body. The device includes an articulated mechanical arm having or accommodating a distal-end first tracked instrument having a tip that has or accommodates a force contact sensor. The device includes an actuator operatively connected to the mechanical arm for adjusting the orientation of the mechanical arm, so as to maintain the trajectory between the tip of the first tracked instrument in the direction of the patient target site. The device includes a tracking mechanism for tracking the orientation of the first tracked instrument in an instrument coordinate system. The device includes a processor operatively connected to the actuator and tracking mechanism. The processor uses a second image capture instrument to construct an image of the target site that is defined by reference to the image-coordinate system. The processor correlates the image coordinate system with an instrument coordinate system to place the target-site coordinate in the instrument coordinate system. The processor determines whether the target site has moved off the first tracked instrument's trajectory towards the target site. The processor computes a correction to the orientation of the first tracked instrument to re-orient the first tracked instrument towards the target site, after determining that the target site has moved off the first tracked instrument's trajectory towards the target site. The processor uses the computed correction to correct the orientation of the first tracked instrument to maintain the first tracked instrument's defined

trajectory toward the target site even as the first tracked instrument is moved in space outside or inside the body.

Applicant respectfully submits that the combination of Van Der Brug, Glassman and Yanof does not disclose, teach, or even suggest such a method. Van Der Brug describes an image assisted surgery system that shows to a user, a position of a surgical instrument in an operating area in the body of a patient during a surgical operation. Van Der Brug's system uses a camera unit and two image sensors to measure the position of a set of IREDs, which are attached to the surgical instrument. Van Der Brug's system does not determines whether the target site has moved off the first tracked instrument's trajectory towards the target site.

Glassman describes an image directed robotic system for precise robotic surgery. Glassman's system includes a camera unit and sensors for tracking a set of LEDs that are attached to the end of a robotic arm that holds a surgical instrument. Glassman's system is used to remove tissue in a patient's body. The process of removing the tissue is automated by Glassman computer system. This automated process prevents the surgical instrument from going outside a pre-determined operating area during the removing of the tissue. Glassman's system requires the patient's body to be locked on a firm base. *See Glassman, column 9, lines 27-29.* Thus, Glassman's system does not provide a mechanism that determines whether the target site has moved off the first tracked instrument's trajectory towards the target site.

Yanof describes a CT scanner with a virtual needle display for planning image guided interventional procedures. Yanof's scanner describes a system that allows a user to move a needle using a mechanical arm, while simultaneously viewing the needle from multiple angles. Yanof's scanner does not describe a system that allows the surgical instrument to be adjusted

when the patient's body moves. Yanof's system describes a surgical instrument that is moved when the couch on which the patient lies is moved. *See Yanof, column 6, lines 5-9.* Thus, Yanof's system moves the mechanical arm in response to a movement in the couch and not a change in the target site.

In contrast, claim 18 recites a device that includes a processor that (1) uses a second image capture instrument to construct an image of the target site that is defined by reference to an image-coordinate system; (2) correlates the image coordinate system with an instrument coordinate system to place the target-site coordinate in the instrument coordinate system; (3) computes a correction to the orientation of the first tracked instrument to re-orient the first tracked instrument towards the target site, when it determines that the target site has moved off the trajectory towards the target site; and (4) uses the computed correction to correct the orientation of the first tracked instrument to maintain the first tracked instrument's defined trajectory towards the target site even as the first tracked instrument is moved in space.

Accordingly, Applicant respectfully submits that the combination of Van Der Brug, Glassman and Yanof does not render claim 18 unpatentable. As claims 19-21 are dependent directly on claim 18, Applicant respectfully submits that claims 19-21 are patentable over the combination of Van Der Brug, Glassman and Yanof for at least the reasons that were discussed above for claim 18.

CONCLUSION

In view of the foregoing, it is submitted that all the claims, namely claims 10-21, are in condition for allowance. Reconsideration of the rejections and objections is requested. Allowance is earnestly solicited at the earliest possible date.

Respectfully submitted,

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